UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

SOUTHERN UTILIZATION RESEARCH BRANCH

SOUTHERN STATES REGIONAL S-9 TECHNICAL COMMITTEE MEETING

at

New Orleans, Louisiana

December 12, 1955

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MEETING OF S-9 NEW PLANTS TECHNICAL COMMITTEE

December 12, 1955

ATTENDANCE LIST

Bennett, H. W., Agronomist, Department of Agronomy, Mississippi Agricultural Experiment Station, Box 157, State College, Mississippi
Dempsey, A. H., Associate Horticulturist, Department of Horticulture, Georgia Agricultural Experiment Station, Experiment, Georgia
Erlanson, C. O., Plant Introduction Section, ARS, USDA, Beltsville, Maryland
Fergus, E. N., Agronomist, Department of Agronomy, University of Kentucky, Lexington 29, Kentucky
Harvey, Paul H., Department of Agronomy, North Carolina State College, Raleigh, North Carolina
Hull, Fred, Department of Agronomy, Florida Agricultural Experiment Station, University of Florida, Gainesville, Florida
James, Edwin, Coordinator, Regional Project S-9, USDA, ARS, Horticultural Crops Research Branch, Regional Plant Introduction Sta., Experiment, Georgia
Langford, W. R., Associate Agronomist, Department of Agronomy, Alabama Polytechnic Institute, Auburn, Alabama
Lewis, R. D., Director, Texas Agricultural Experiment Station, College Station, Texas
Martin, J. A., Department of Horticulture, South Carolina Agricultural Experiment Station, Clemson Agricultural College, Clemson, South Carolina
Matlock, Ralph S., Department of Agronomy, Oklahoma A. & M. College, Stillwater, Oklahoma
Miller, Julian C., Head, Horticultural Research, Louisiana State University, Agronomy-Horticulture Bldg., Baton Rouge 3, Louisiana
Reeves, R. G., Department of Agronomy, Texas Agricultural Experiment Station, Texas A. & M. College, College Station, Texas
Thomas, Rex, Experiment Station Administrator, USDA, ARS, Office of Experiment Stations, Washington 25, D. C.
Thurman, R. L., Assistant Agronomist, Department of Agronomy, Arkansas Agricultural Experiment Station, University of Arkansas, Fayetteville, Ark.
Underwood, J. K., Associate Agronomist, Department of Agronomy, Tennessee Agricultural Experiment Station, University of Tennessee, Knoxville, Tenn.
Woodbury, Roy O., University of Puerto Rico, Agricultural Experiment Station, Rio Piedras, Puerto Rico

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Fisher, C. H.
Goheen, G. E.
Dollear, F. G.
Gastrock, E. A.
Vix, H. L. E.
Hall, R.

McFarlane, V. H.
Arthur, J. C.
Dawson, P. R.
Hopper, T. H.
Frampton, V. L.

II.

Agenda for S-9 Technical Committee Meeting
December 12-13, 1955
Southern Utilization Research Branch, New Orleans

1. Appointment of chairman, pro-tem by committee.

2. Report of activities of Primary Station during 1954-55 - Edwin James.

3. Report of work by States - State Representatives.

4. Report of Plant Introduction Section - C. O. Erlanson.

5. Report on Domestic Explorations - R. G. Reeves.

6. Discussion of previous and future anticipated utilization of plant introductions - (a) Ideas for encouraging use of materials, such as graduate programs, etc.

7. Discussion of continued maintenance, including bulking of similar accessions.

8. Discussion of more extensive specific and thorough evaluations of plant materials. This discussion could be led by regional coordinator.

9. Recent developments in the industrial utilization of plants and plant materials - Staff of Southern Utilization Research Branch.

10. Some apparent needs of industry for products obtained from plants - Staff of Southern Utilization Research Branch.

11. New plants adapted to some section of the South, with meager information as to their utilization - Committee discussion.

12. Publications. Release of information to the public concerning the activities of the New Plants Project - Committee discussion.

13. Proposals for new explorations - Discussion leader J. C. Miller or Fred Hull.

14. Financial report and budgetary recommendations - Edwin James.

15. Election of officers for 1955-56.

16. Time and place of next meeting.

III.

AGENDA* FOR SURB STAFF PRESENTATION

Item 9: Recent developments in the industrial utilization of plants and plant materials, and

Item 10: Some apparent needs of industry for products obtained from plants.

December 12, 1955

P. M.

Introductory Remarks - -	C. H. Fisher, Chief, SURB G. E. Goheen, Assistant Chief, SURB
Some comments on the place for new crops or products in the Agricultural Market	R. Hall of Agricultural Marketing Service
Report of some work in Oilseed Section	F. G. Dollear, Assistant Head
Report of work in Engineering and Development Section	E. A. Gastrock, Head
Fruit & Vegetable Utilization Research in Southern Region	V. H. McFarlane, Head, Fruit & Vegetable Section
Comments on Possible Utilization of New Crops	T. H. Hopper, Head, Analytical, Physical-Chemical & Physics Section
Discussion	

*Other items on the S-9 Committee Agenda were not attended by SURB members.

IV. SUMMARY OF PRESENTATIONS BY LABORATORY STAFF

SURB's part of the program was confined to the afternoon session of December 12. After the group had been welcomed by Dr. Fisher, who emphasized our desire to cooperate fully with the S-9 Committee in their problems dealing with the utilization of new plants, G. E. Goheen served as Chairman and introduced the several speakers. Goheen presented a classification of the basic human needs which may be considered in utilization of any commodity as follows: (1) Food (and all its ramifications, including feed, medicines, etc.), (2) Clothing, (3) Shelter, (4) Transportation, (5) Communications, (6) Recreation.

The above needs may be re-grouped or classified: (1) Food market, (2) Feed market, (3) Industrial market, (4) Export-import market.

From an industrial standpoint the major consumer needs or desires must be further broken down into classes of products such as plastics and resins; soaps and detergents; paints, varnishes, printing inks, etc.; lubricants; insecticides; and fibers.

Agricultural products may be a source of organic compounds useful as intermediates in these fields.

New plants may be a new source of supply for organic compounds presently used in large volume or potentially useful if supply and price were favorable.

The determination of chemical composition of the new plants would be a primary step in making a decision on this point. Thus,

Proteins - have been used to make a fiber. Zein fiber from corn protein makes a good textile blend, already worth 5-6 million dollars/yr.

Carbohydrates - are being considered as a replacement for ethylene oxide in the manufacture of synthetic detergents or surface active agents.

Vegetable fats and oils - are well established as sources of fatty acids for paints, varnishes, drying oils, printing inks, linoleum, oilcloth, lubricants, plasticizers, detergents and other surface active materials, and chemical derivatives such as amides, amines, etc. for a wide variety of uses.

When new crops are used for foods and feeds they are competitive with present crops. Some industrial uses are, however, non-competitive.

Place for New Crops and Products in Agricultural Markets

Synopsis of talk by Richard Hall of AMS

Records of production and productive efficiency with falling income indicate a need for new crops as a result of a westward movement in production area of basic crops, rapid changes in consumer wants and needs, alternative enterprises for farmers faced with acreage cuts, need for more desirable varieties of present crops, and the mere fact we have a surplus of present crops.

On a broad market basis indications are that in the Food market consumers want a clean, convenient, all consumable product with a uniform quality maintained until product is ready to use. The Industrial market vies for raw materials with fairly stable prices and supply, tailor-made for specific end uses. The Feed market is finding nutrition, palatability, and additives for feed important in economic utilization. The Export market is most difficult to

develop because production and marketing efficiency must be based on improved technology to export at world prices. For the Import market technology must find ways to cut agricultural imports to pay for future imports of industrial raw materials.

There is no panacea available but the challenge can be handled adequately by teamwork in research, production, processing, and marketing.

Report of Some Work in Oilseed Section

Abstract of Talk by F. G. Dollear, Assistant Head

All of the research in the Oilseed Section is on plant materials. All of the research is aimed at increasing utilization. Commodities on which we work are cottonseed, peanuts, tung nuts, and rice.

Cottonseed research is on meal and on oil. We are striving to improve cottonseed meal and expand its utilization into poultry and swine feeds. Research on cottonseed processing carried out cooperatively with the National Cottonseed Products Association, oil mills, and federal and state nutritionists has demonstrated that satisfactory meals for growing poultry can be produced by low temperature cooking in prepress solvent type processing plants. Such meals generally have low free gossypol content and high nitrogen solubility indicating little protein damage. As a result of these investigations 250,000 tons of cottonseed meal were used in mixed feeds last year. However, there are still problems with egg yolk discoloration when cottonseed meal is fed to laying hens. More basic

information is needed on the effect of processing on nutritive value, particularly for swine feed. We are studying the amino acid content of protein fractions as well as new processing techniques to achieve lower free gossypol content with minimum heat damage to the protein. And plant breeders are now working to lower the gossypol content of the seed.

Research on cottonseed oil is in the field of food uses and nonfood uses. We have modified the glycerides of cottonseed oil by incorporating acetic acid to produce acetoglycerides. Some of these are waxy, nongreasy, flexible fats which may have application as food coatings to prevent moisture loss in meats, cheese, etc. Other modified glycerides may find use as edible lubricants, as pan greases, or as plasticizers where the plastic comes into contact with foods. We have a contract under which these modified fats are being tested to prove their edibility. Two firms have made them on a pilot plant scale and their production awaits approval for food use. In the field of nonfood uses we are investigating derivatives of linoleic acid, the principal component of cottonseed oil, and eleostearic acid, the principal component of tung oil, for use as plasticizers, agricultural chemicals, biologically active compounds, and emulsifiers. We are isolating the toxic constituent of tung meal in order that we may learn how to detoxify it so that it can be used in feeds.

Our research on peanuts and rice centers on their food use and the determination of compositional factors affecting quality. We are isolating a "bitter principle" from peanuts that may contribute to undesirable flavors to which the trade objects and which may be associated with rapid airing or immaturity. We are looking for compositional factors affecting the cooking quality of rice. We have also done research on production and processing characteristics of rice oil and wax.

What are the needs of industry for products obtained from plants? Biologically active compounds, insecticides, and pharmaceuticals are industrial fields for plant materials. Sterols, sitosterol, stigmasterol, and cortisone precursors are in demand.

Of vegetable oils we have a surplus, but waxes are mostly imported. A domestic source of high quality vegetable wax should find industrial markets. Oils of unusual chemical structure, such as kamala oil containing kamlolenic acid HO-----$(CH = CH)_3$ ------COOH, would be good industrial raw materials.

Proteins and forage crops high in protein content are needed. Of particular interest would be plant materials having a high lysine content, since only animal proteins presently supply adequate amounts of this essential amino acid. Methionine is another amino acid that is in demand for feeds.

To summarize, more and better quality proteins, domestic vegetable waxes, or oils of unusual structure, should find ready markets.

REPORT OF WORK IN ED SECTION

By E. A. Gastrock and H. L. E. Vix

The work in the Engineering and Development Section directed toward the industrial utilization of new and unusual plants has ranged from an extensive investigation of golden rod rubber (about 36 man-years) to lesser efforts on other plants varying from a few man-months to several man-years. The plants receiving attention in ED Section in addition to golden rod included: (1) (for oil and/or protein) sesame, castor beans, rice (bran), okra seed, cucurbits, white skinned peanuts; (2) (for starch, feed, and food) sweetpotatoes; (3) (for wax) jojoba, rice (bran), and sugarcane.

The Section is composed of four units: Product Development - J. J. Spadaro; Process Development - H. L. E. Vix; Cotton - H. L. E. Vix; Industrial Analysis - K. M. Decossas. Dr. E. F. Pollard is Assistant Section Head. The Chemical Engineers in the Section have varied industrial experience in the following fields: Vegetable Oil and Oilseed Processing; Paints and Varnishes; Pulp and Paper; Fermentation; Insulation Board; etc.

Facilities available in ED Section include equipment for extraction with aqueous and non-aqueous solvents; for hydraulic and screw pressing; for rolling, grinding, and comminuting in different ways; for separating and cleaning by sifting and air aspiration; for centrifuging (several types of batch and continuous units); for drying (batch and continuous); for oil processing and other reactions. Processing temperatures available range from about 0° F. using ammonia refrigeration up to about 500° F. or 600° F., using Dowtherm heating. Pressures range from a moderately high vacuum up to about 400 pounds per square inch. These temperature and pressure ranges apply to pilot plant batches of from 5 to 50 gallons.

A brief resume' of the work on sesame and castor beans was presented by Mr. Vix. These may be processed successfully by the filtration-extraction process (without preliminary screw pressing) to yield high quality oil and meal for sesame and high quality oil from castor. In the castor meal from the process the toxic principle, ricin, has been destroyed and there is some evidence of reduced allergenic properties also which is presently being evaluated.

FRUIT AND VEGETABLE UTILIZATION RESEARCH - SOUTHERN REGION

Abstract of talk by Vernon H. McFarlane

Status of Utilization of Some Southern Fruit and Vegetable Crops. - Federal, state, industry and endowed and private research laboratories have contributed products and processes which have aided materially in improving the economic status of several of the Southern Region's fruit and vegetable crops. Contributions made in the citrus industry are perhaps the most outstanding. Products developed or improved upon over the years are: canned sections, canned juices and juice blends, essential oil, marmalade, candied peel, pectin, citric acid, pulp, dehydrated peel, citrus molasses, vinegar, wines, liquors, industrial alcohol, citrus feed yeast, citrus seed oil, citrus seed meal and hulls, bland syrup, waxes, hesperidin, naringin, citrus purees, superconcentrates, ades and squashes, chilled juice, bioflavonoids, d-limonene, orange powder, and orange concentrate. The last named is the spectacular product whose ready marketability has stimulated citrus production. Because the increased production of citrus fruit is sizable there are now available large enough supplies of raw materials and wastes to encourage research to increase their utilization and to permit the profitable manufacture of many citrus products. We haven't even started to investigate the possibilities of the new products that may be derived from some of the constituents such as pectin, hesperidin, naringin and d-limonene.

Utilization research has not accomplished as much for crops such as sweetpotatoes, carrots, avocados, okra and the like but it is making progress in assisting them. Notwithstanding the many useful products produced from these and several other fruits and vegetables produced in quantity in the South, the work of the utilization scientist is only just at the beginning. For the most

part established processing procedures are being applied or adapted to each commodity. New and improved products have, in general, resulted from technological advances. A new food product or the processed product of a new commodity has seldom been successfully introduced unless by chance it contained a constituent which satisfied the particular food fad requirement of the moment. All the "tricks of the trade" are being applied to improve the processed products manufactured from crops already in large production. Research of a fundamental nature is likewise being restricted to these crops. It may be said that there is not too much of the latter. In spite of the immense amount of processing information available, we would be in a bad way, if we suddenly found it necessary to introduce new fruit and vegetable crops and had to provide information for their immediate complete and efficient utilization. Our programs of utilization research are adequate as long as we assume today's crops are the best and will remain so indefinitely. We are likely to find the program very inadequate, however, if the population demands increase as rapidly as estimated. This will be especially true if good land is no longer available for the accustomed crops and we must either learn how to use new crops which will be more productive on this same land or which may be harvested from the "wastelands" of today. Investigations of the possibilities of new crops are practically in abeyance.

Fruit and Vegetable Utilization Research underway in the Southern Utilization Research Branch, ARS, USDA. The Southern Utilization Research Branch has only about one-tenth of the total ARS research program on fruits and vegetables. It currently has basic and applied investigations underway on citrus fruits, cucumbers, sweetpotatoes and southern peas, and to a much lesser extent on a half-dozen other commodities. The Eastern Utilization Research Branch has about

twice this size program. By far the greater part of the ARS utilization research on fruits and vegetables is conducted in the laboratories of the Western Utilization Research Branch. The programs underway in the Eastern and Western Branches are similar to the one in progress at the Southern Branch but treat in general with the principal commodities of their respective regions.

Participation of Utilization Research in the Evaluation of New Plants.

It is not likely that a new plants program to investigate the potential economic value of introduced and native (not commercially grown) plants can be very successful unless the utilization of each plant is thoroughly explored with respect to all its parts. Contributions which utilization research scientist can assist in making to a new plants program are:

1. Determine the processing characteristics of the edible part of the plant. Will it make a good canned, frozen, dehydrated or fermented product,etc.?

2. Develop new or adapt established processing procedures to the peculiarities of the plant product - (determine special processing techniques required, design special equipment, etc.).

3. Determine processing plant costs and plan processing plant layouts.

4. Determine the constituents of nutritional value - quantitative evaluation of - vitamins, kinds of protein and amino acids, kinds of starches, sugars, and other carbohydrate compounds, kinds of organic acids, nature of the lipid material present, etc.; minor elements present, etc. If the edible part is not especially palatable can it be made more so? Can it or its products be blended or used to fortify others? If toxic, can it be detoxified?

5. Determine the constituents in other plant parts which may have feed value - fresh, dehydrated, silage, etc.

6. Analyze all parts of the plant for biologically active compounds - plant hormones, precursors for medicinal compounds, antibiotics, insecticides, flavonoids, alkaloids, etc.

7. Investigate the major enzyme systems in the plant; in order to control their activity during processing and in the processed products; or as a source of enzyme for commercial production.

8. Based on analyses of constituents, evaluate the plant parts and juices for industrial use: essential oils, perfumes, alcohol, feed yeast, fiber (paper, insulation, etc.) used in culture media for antibiotic production, or other economically valuable microbial synthesized products.

9. Determine if major constituent or constituents readily isolated and purified and suitable for organic synthesis - development of more economically valuable compounds.

10. Investigate the biochemical reactions occurring in the raw and processed material, as related to the quality and stability of the processed products, and develop methods for their control.

There are undoubtedly other ways in which utilization research might give valuable assistance. No effort is being made here to suggest a screening procedure which might be followed. It will take a variety of scientific talents to design a procedure which will be thorough and which will still meet practical limitations. This will be especially true if a large number of new plants are to be investigated and if our diverse agricultural and industrial needs are to be met. We are now enjoying a period of plenty and of surpluses not only in agriculture but also in many other industries in the United States. One can conceive of no more opportune time for long range planning to meet the agricultural needs of the future.

Comments on Possible Utilization of New Crops

Abstract of talk by T. H. Hopper

The utilization of new crops is dependent on the economy of their production and on their yielding materials that serve a useful purpose. For them to find a permanent place in American agriculture the utilization requirements should command the planting of considerable acreages. For this to be met the products obtained should not be in competition with surplus commodities. Thus plants that

serve as pasture grasses and forages; sources of imported items such as special fats and oils, gums, resins, and condiments; or can be used as sources of medicinals should receive attention as new sources of farm income from lands withdrawn from surplus crop production.

Studies of the chemical composition of plants are urged as basic to the selection of new crops and to genetical improvement of them for supplying new, essential, and important items for commerce. In this connection increased attention to chemical composition would seem to be in order in the search for new germ plasm for improving varieties of present crops. Evidence of success in improving corn, soybean, wheat, and flaxseed by collaboration of the chemist and the geneticist is cited. Some consider an improved variety equivalent to a new crop.

V. NOTES ON DISCUSSIONS

There are four regional projects on new plants; i.e., Southern (S-9), Western, Northeastern and Northcentral. A National Coordinating Committee coordinates all programs - State, Federal and Regional - on new plants.

Dr. C. O. Erlanson, Plant Introduction Section, discussed the Federal Plant Introduction work and emphasized that they are looking for new crops for surplus acreage and new plant materials which would be sources of drugs for heart depressants (requested by the Public Health Service) etc. New forage crops are important and also ornamental plants represent a big industry. There are four Federal gardens at which screening work has been carried out on new crops. The major collecting phase of this work is considered to be about completed. A National seed storage facility is badly needed. Federal utilization work has been along the following lines: (1) Bamboo, which appears to have some value as a paper pulp for such specialties as cigarette paper, thin paper for bibles, kleenex and filter paper. Production studies with bamboo are hindered by the fact that the plant requires about nine years to obtain a sufficient growth for study. Much of this Federal utilization work has been handled through contract projects. (2) The wild yam as a source for cortisone has been developed to the point that it may contain 8 1/2 to 10 percent of starting chemical. These species may soon be submitted to the Southern Region State group. (3) The seed of the shrub Simmondsia Chinensis (or Jojoba) has been studied as a wax substitute for Carnauba. It was stated that waxiness can be bred into sorghum if there is a need for waxy starch types. Also some of the newer hybrid sorghums have yellow endosperm. Would this be any advantage in feed or commercial utilization? Tannin content can be increased or decreased by plant breeders.

Lespedeza sericea becomes quite woody in the summer and may have possibilities as a fiber crop.

Dr. R. D. Lewis mentioned that the S-9 New Plants Technical Committee has been working on the production of new plants, with very little attention to the utilization. It is now generally agreed that cooperative work on production and utilization would be of considerable value. Dr. Lewis mentioned problems dealing with sorghum, grasses and legumes, avocado (more cold resistant varieties are now available) and green wrap tomatoes (the most important vegetable crop in the South). We need to know how the nutritional value of green wrap tomatoes compares with vine ripened. Dr. Julian Miller, LSU, said he could find little difference in Vitamin C content.

Dr. J. C. Miller mentioned work at LSU on sweetpotatoes, okra, avocado and the need for winter crops. They are looking at off-grade sweetpotatoes as a source of flour. They have someone experimenting with okra, grinding the whole pods and using the material as a spreading agent in paper making. Cotton needs new properties to recapture the market for shirts.

Dr. Reeves stated that the Sunchoke, which appears to be a cross between the Jerusalem artichoke, Helianthus tuberosus, and the Mexican Sunflower, H. stromosus, grows well and is a good producer under very dry conditions, is a good source of carbohydrates and of inulin which can be hydrolyzed to give fructose. He also said Guar would grow well under dry conditions and produce a meal equal to cottonseed meal as a feed.

Other items discussed by Committee members concern a variety of corn which the earworm would not eat, plants for essential oils, silage plants, Kenaf, ramie, and sesame. The U.S.D.A. discovered that sesamolin, a sesame oil derivative, is

the most potent pyrethrum synergist known. A 1:1 by weight mixture boosts fly killing activity of pyrethrum 31 times. Presently used piperonyl butoxide boosts the activity only 12 times. Present sales of pyrethrum insecticides amount to 50 million pounds per year.

Mr. J. A. Martin, Clemson, discussed their work with sesame. The Nutrition Department at the University is preparing a recipe for use of whole sesame seed on cookies, candies, etc. They are also investigating the possibilities of sesame flour and methods of producing a sanitary flour. Mr. Martin is interested in the "hot stuff" in red peppers and thinks someone should isolate the compounds responsible for this characteristic.

The plant screening program at EURB was mentioned, but one person expressed the opinion that this screening program did not provide sufficient quantitative data on many of the components of new plants to provide all of the desirable information. They would like more information on flavanoids, alkaloids, tannins, and glycosides. Of legumes, ground vetch might be examined from the chemical angle. It is an extremely bitter seed and plant.

Compiled by GEGoheen:mwh-1/17/56.